

U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Pyrgulopsis gilae

Common Name:

Gila springsnail

Lead region:

Region 2 (Southwest Region)

Information current as of:

04/01/2011

Status/Action

☐ Funding provided for a proposed rule. Assessment not updated.

☐ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

☐ New Candidate

☐ Continuing Candidate

☒ Candidate Removal

☒ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status

☐ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species

☐ Range is no longer a U.S. territory

☐ Insufficient information exists on biological vulnerability and threats to support listing

☐ Taxon mistakenly included in past notice of review

☐ Taxon does not meet the definition of "species"

☐ Taxon believed to be extinct

☐ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

Petition Information

___ Non-Petitioned

X Petitioned - Date petition received: 11/22/1985

90-Day Positive:08/26/1986

12 Month Positive:10/04/1988

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **No**

To Date, has publication of the proposal to list been precluded by other higher priority listing?
Not Applicable

Explanation of why precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, the majority of our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements; meeting statutory deadlines for petition findings or listing determinations; emergency listing evaluations and determinations; and essential litigation-related administrative and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of Progress on Revising the Lists, in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov/>).

Historical States/Territories/Countries of Occurrence:

- **States/US Territories:** New Mexico
- **US Counties:** County information not available
- **Countries:** Country information not available

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories:** New Mexico
- **US Counties:** Catron, NM, Grant, NM
- **Countries:** Country information not available

Land Ownership:

Between 1 to 2 kilometers (km) (0.6 to 1.2 miles (mi) of occupied habitat (all springbrook lengths from all locations are combined); approximately 80 percent Forest Service, 20 percent private.

Lead Region Contact:**Lead Field Office Contact:**

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Biological Information**Species Description:**

The Gila springsnail is a tiny (3.1 to 4.0 millimeters (mm) (0.12 to 0.16 inches (in)) shell length) (Taylor 1987, p. 18) freshwater snail. The species has distinctive penial morphology that includes a horseshoe-shaped terminal gland (Taylor 1987, p. 17). The species is morphologically and genetically distinct from other *Pyrgulopsis* species in the Colorado River basin, including the New Mexico springsnail (Hurt 2004, p. 13).

Taxonomy:

The Gila springsnail is in the family Hydrobiidae, which is distinguished by the presence of eyes on long antennae and a globular to narrowly conical shell (Taylor 1987, p. 9). The Gila springsnail was originally described as *Fontelicella gilae* by Taylor (1987, pp. 16-18) and was moved to the genus *Pyrgulopsis* by Hershler (Hershler 1994, pp. 36-38). A recent analysis of mitochondrial genetics of Gila springsnail reveals that there appear to be genetic differences among populations of the species (Hershler and Liu 2010, p. 4). These genetic and morphological data indicate that the Gila springsnail may be represented by three geographically disjunct subgroups that are actually separate species. One subgroup is in the upper East Fork Gila River watershed, another is in the Middle Fork Gila River watershed, and the third subgroup (including the type locality of Gila springsnail) is in the lower East Fork and mainstem Gila River watershed (Hershler and Liu 2010, p. 4). However, this initial genetic analysis was based on a single gene (mitochondrial COI), and morphologic analyses have not been completed. Additional genetic and morphologic analyses are planned for the future and may lead to a taxonomic revision of the Gila springsnail (Hershler and Liu 2010, p. 5). Therefore, until the genetic and morphologic data are confirmed and new species are described in peer-reviewed literature, we consider all locations of Gila springsnail as it is currently described to be the Gila springsnail.

However, in this current status review we have considered the possible implications of a future taxonomic revision of the Gila springsnail. If a taxonomic revision occurs, the likely outcome would be that the distribution of the Gila springsnail (the candidate species under review) would be limited to those locations in the lower East Fork and mainstem Gila River watershed. So while we will analyze the threats to the Gila springsnail as though all of the known locations to date are a single species (that is, *P. gilae*, the Gila springsnail), we considered whether any potential threats may be disproportionately affecting the lower East Fork and mainstem Gila River areas. Additionally, any new species described in the future (from the other two subgroups) are not directly considered in this analysis, but threats to those populations are considered in the context of the species as a whole. Any new species described in the future would require an independent analysis and evaluations for listing under the Endangered Species Act.

Habitat/Life History:

Springsnails in the genus *Pyrgulopsis* are egg-layers with a single small egg capsule deposited on a hard surface (Hershler 1998, p. 14). The larval stage is completed in the egg capsule, and upon hatching, tiny snails emerge into their adult habitat (Brusca and Brusca 1990, p. 759; Hershler and Sada 2002, p. 256). Most hydrobiid snails reproduce several times during the breeding period (spring to fall) with varying generation

length. The sexes are separate and physical differences are noticeable between them, with females being larger than males. Mobility is limited and significant dispersal likely does not occur, although aquatic snails have been transported by becoming attached to the feet and feathers of migratory birds (Roscoe 1955, p. 66; Dundee et al. 1967, pp. 89-90; Hershler et al. 2005, p. 1763). Most freshwater snails are herbivores or detritivores that consume algae, bacteria, and decaying organic material, or that passively ingest small invertebrates while feeding. Respiration in hydrobiid snails is strictly aquatic via an internal gill with some oxygen absorption through the mantle (soft body). While longevity is variable, most prosobranch snails (snails that have gills and an operculum) live 9 to 15 months (Pennak 1989, p. 552; Brown 1991, p. 291).

The Gila springsnail is found in seeps and springs along the Gila River, East Fork Gila River, and Middle Fork Gila River in the Gila National Forest and on private land within the boundaries of the Forest in Catron and Grant Counties, New Mexico. This area is in a relatively remote section of the Forest, with the Gila Cliff Dwellings National Monument being the only nearby human development. Aside from the river corridors, the area is encompassed by the Gila Wilderness. The watershed is relatively unaltered, with the only human impacts being roads (alongside the Gila River) and grazing. Silver City is the closest metropolitan area, over 45 miles away.

At the location where the species was first discovered, also referred to as the type locality, on the East Fork Gila River (Taylor 1987, p. 16), the Gila springsnail inhabits cool waters (20°C (68°F)) that issue from narrow, watercress (*Nasturtium* spp.)-lined rivulets of a vertical volcanic cliff often termed hanging springs (Lang 2011, p. 1). A second, smaller Gila springsnail population exists in the warmer waters (32 to 33°C (89.6 to 91°F)) of a nearby spring (Taylor 1987, p. 18). Gila springsnail populations occupy small (10 to 25 square meters (m²) (108 to 270 square feet (ft²)), eurythermal (wide range of temperatures) (13.8 to 38.6°C (56.8 to 101.5°F)) habitats (Lang 2011, p. 2) ranging from highly degraded to relatively undisturbed thermal springs. Sites containing Gila springsnail in the upper East Fork Gila River and Taylor Creek occur at springs that are adjacent to and run across the upper floodplain terrace of the river. These sites are wetland/marsh habitat with narrow (approximately 0.3 m (1 ft)) springbrooks that flow over substrates of sand, silt, and gravel. The springbrooks often support plants like watercress, and sedges (*Scripus* spp.) and rushes (*Juncus* spp.) line the banks. These sites in general are low gradient and very different in character from the rock faces where the springsnails occur along the lower East Fork Gila River and Alum Spring. This difference in habitat lends further evidence to the hypothesis that these upper East Fork Gila River populations may be a separate species. The springs in which the Gila springsnail are found have very low discharge (flow rate), typically less than 4 liters per second (lps) (1 gallon per second (gps)), and a short springbrook length, ranging from 10 to 400 m (33 to 1,300 ft) (Myers and Lang 2009, pp. 3-4). All known Gila springsnail sites are adjacent to larger streams (Gila River, East Fork Gila River, and Middle Fork Gila River) (Myers 2009, pp. 1-80).

Historical Range/Distribution:

When the Gila springsnail first became a candidate species in 1988, it was known from 13 separate populations along the East Fork, Middle Fork, and mainstem Gila Rivers: two populations along Beaver Creek and Taylor Creek, which form the headwaters of the East Fork Gila River, another population in Fall Spring, also in the upper East Fork Gila River drainage, and the remaining eight disjunct populations associated with a series of springs along the lower East Fork, Middle Fork, and mainstem of the Gila River (Forest Service 2004, p. 528).

Current Range Distribution:

In 2008 and 2009, Myers and Lang (2009, pp. 1-4) surveyed occupied and potential habitat in the Gila drainage and discovered many new sites for these springsnails, bringing the total number of occupied locations to 50 (Figure 1) (Lang 2009, p. 14-15; Myers 2009, pp. 1-80; Myers and Lang 2009, pp. 1-4). In the headwaters of the East Fork Gila River, 26 occupied sites, 22 more than were previously known, have now

been documented: 11 along Beaver Creek, 12 along Taylor Creek, and three adjacent to the upper East Fork Gila River. Along the lower East Fork Gila River near the confluence with the Gila River, 12 sites, up from 4 previously known, are associated with a series of four springs. These locations, along with Alum Spring, would comprise the range of Gila springsnail if a taxonomic revision of the species occurs (Hershler and Liu 2010, p. 5). On the Middle Fork Gila River near Jordan Spring, 12 additional sites, 10 more than were previously known occur in springs along the river. There has been no extirpation of Gila springsnail from any occupied spring in its historical range.

Population Estimates/Status:

Mehlhop (1992, p. 4; 1993, pp. 2-3) reported on the status of hydrobiid snails in the Gila River. Although density measurements were not made for the species, populations of the Gila springsnail were reported as stable in October 2001 and June 2002 (Lang 2002, pp. 9-10). Surveys conducted in 2008 and 2009 by personnel from the Service and NMDGF indicated that the majority of habitats were in good to excellent condition (Myers 2009, pp. 1-80), and Gila springsnails were typically abundant with several hundred to several thousand individuals estimated to occur at the sites surveyed in 2008 and 2009 (Myers and Lang 2009, pp. 3-4). The Gila springsnail exhibits seasonal variation in numbers and is not uniformly distributed at a site. Given that the populations have been stable over nearly 20 years of surveys and there has been no evidence of decline at any occupied locations, seasonal fluctuations in numbers does not necessarily indicate population decline.

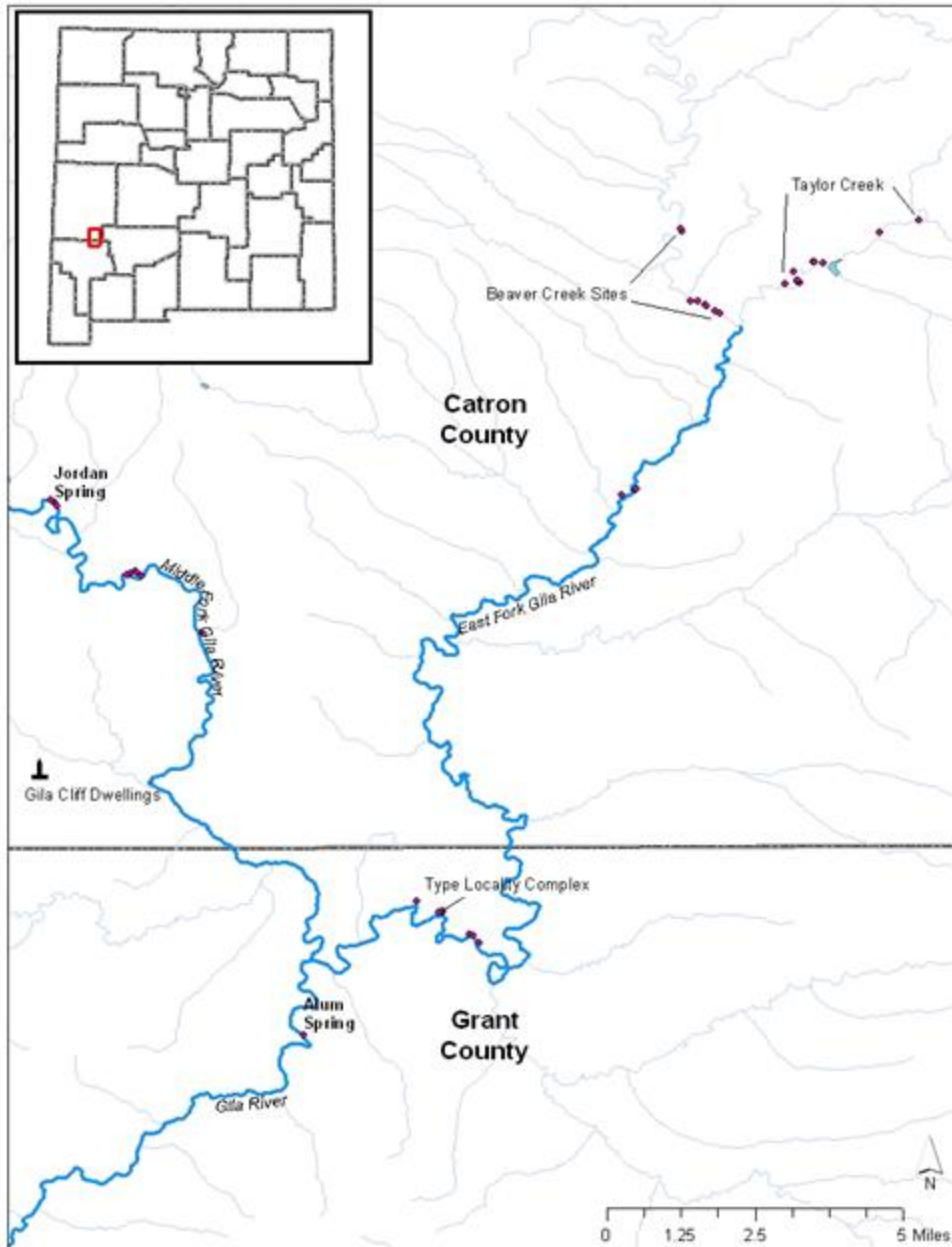


Figure 1. Springs inhabited by the Gila springsnail.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Previous status reviews (e.g., Service 2010, pp. 4-8) have identified the following threats to Gila springsnail habitat: recreational activities, spring modification, livestock grazing, fire, flooding, and groundwater decline. New information collected during site visits in 2008 and 2009 to the majority of known occupied sites showed there was little evidence of direct threats to the populations (Myers and Lang 2009, p. 1).

Recreational activities: Most of the sites inhabited by Gila springsnail are not subject to frequent recreational visitors. Only two of the sites inhabited by the species (Alum Spring and springs near Jordan Spring) are subject to regular recreational use, such as spring visitation by people hiking or on horseback, which may

result in changes in water quality, increased sedimentation, and changes in temperature (Forest Service 2004, p. 534). Two of the sites visited in 2008 and 2009 are adjacent to thermal springs that are destination sites for recreationalists visiting Gila National Forest: Jordan Spring on the Middle Fork Gila River and Alum Spring on the mainstem Gila River. These warm water sites would most likely be affected by greater visitation and recreational use than the cool water springs, as visitors enjoy bathing in thermal springs. While it was evident that recreationalists use both sites, impacts to occupied habitat were very low or not evident at the time of the surveys (August 2008 and 2009), and springsnails were abundant (Myers 2009, pp. 1-80; Myers and Lang 2009, pp. 3-4). Jordan Spring, a thermal spring, is not occupied by springsnails; it was thoroughly surveyed in 2008, and no springsnails or evidence of their empty shells were found. Instead, occupied habitat occurs in a series of six cool water springbrooks that are located downriver approximately 40 m (130 ft) and disjunct from Jordan Spring. The springheads arise from the base of cliffs and run over a relatively flat terrace before joining and then flowing into the Middle Fork Gila River. The springheads are protected by dense growths of sedge. Although there is evidence of some dispersed camping use on the adjacent upland terrace, the springbrooks were in excellent condition and did not appear to be degraded by past or current recreational use in the area. Jordan Spring has been modified by recreationalists to create a large soaking pool but there has been no modification of the cool water springbrooks where the springsnails occur.

The effects of recreational use were also documented at Alum Spring adjacent to a developed hiking trail (Forest Service 2004, p. 547; Lang 2009, p. 22). In 2001, visitors created a series of shallow pools at the base of the cliff over which the spring water flows. The springs downstream of the created pools yielded empty shells of Gila springsnails, indicating possible impacts to the species likely due to the change in water quality and quantity flowing from the pools (Lang 2002, p. 10; Forest Service 2004, p. 535; Lang 2009, pp. 23-24). Above the floodplain is a nearly vertical rock wall, and Gila springsnails are currently restricted to this portion of Alum Spring, which is nearest the springhead (Lang 2009, p. 22). This area is unlikely to be modified by people because its location atop a rock wall makes access difficult (Myers 2009, p. 2). While an occasional recreationalist may climb up the wall, the riparian habitat was in good condition, and use of this area appeared to be low (no litter, fire rings, or semi-permanent structures observed during site visits) (Myers 2009, pp. 5-6). Because of the inaccessibility of the location, it seems unlikely that recreationalists would modify the flow or otherwise degrade springsnail habitat at the upper portions of the spring. While recreational use is evident in portions of Alum Spring, potential effects to currently occupied habitat at this site were considered very low, localized, or not evident in 2008 and 2009 when Gila springsnails were abundant (Myers 2009, p. 2; Myers and Lang 2009, p. 4), and populations at Alum Spring appear to be stable (Lang 2009, p. 14; Myers and Lang 2009, pp. 3-4). Because currently occupied habitat at Alum Spring is unlikely to receive recreational use, the snails occurring at the Jordan Spring site are found in cooler water pools that receive less recreational use than the adjacent warm water pools, and no other occupied springs had evidence of recreation (Myers 2009, pp. 1-80), the effects of recreational activity do not threaten the Gila springsnail.

Spring Modification: Spring modification can occur in the following ways: (1) when attempts are made to increase flow through excavation at the springhead; (2) when the springhead is tapped to direct the flow into a pipe and then into a tank or a pond; (3) when excavation around the springhead creates a pool, inundating the springhead; or (4) when the springbrook is dammed to create a pool. Because springsnails are typically most abundant in the upper reaches of springbrooks, where water chemistry and water quality are normally stable, any modification of the springhead or downstream flow could be detrimental to springsnail populations. In addition, any modification or construction done at the springhead could also affect individuals downstream through siltation of habitat. Because springsnails are typically found in shallow flowing water, inundation that alters springsnail habitat by changing water depth, velocity, substrate composition, vegetation, and water chemistry can cause population reduction or extirpation. For example, inundation has negatively affected populations of other springsnails such as Koster's springsnail (*Juturnia kosteri*) and Roswell springsnail (*Pyrgulopsis roswellensis*) at Bitter Lake National Wildlife Refuge and caused their extirpation from North Spring (NMDGF 2005, p. 22; 70 FR 46304, August 9, 2005). The Gila springsnail is considered a sensitive species by the Forest Service (Forest Service 2004, p. 12), and as such, management actions must maintain or improve habitat for the species (Forest Service 2004, p. 549); therefore, spring

modification is unlikely to occur as a result of Forest Service management actions. See Factor D (Inadequacy of Existing Regulatory Mechanisms) below for more information on the Forest Service's management direction that would protect the Gila springsnail and its habitat. However, as discussed above, the remote location of the springs and their occurrence primarily on Forest Service land makes it very unlikely that any spring modification will occur that would affect the Gila springsnail.

Livestock grazing: It is estimated that livestock grazing has damaged approximately 80 percent of stream and riparian ecosystems in the western United States (Belsky et al. 1999, p. 419). The damage occurs from increased sedimentation, decreased water quality, and trampling and overgrazing stream banks where succulent (high water content) forage exists (Armour et al. 1994, p. 10; Fleischner 1994, p. 631; Belsky et al. 1999, p. 419).

Livestock grazing on spring ecosystems can alter or remove springsnail habitat, resulting in restricted distribution or extirpation of springsnails. For example, cattle trampling at a spring in Owens Valley, California, reduced banks to mud and sparse grass, limiting the occurrence of the endangered Fish Slough springsnail (*P. pertubata*) (Bruce and White 1998, pp. 3–4). Excessive livestock use of springbrooks can directly affect springsnails through contamination of aquatic habitat from feces and urine, habitat degradation of the springbrook by trampling of substrate and aquatic and riparian vegetation, and crushing of individuals.

Gila springsnail habitat occurs in three grazing allotments. The grazing allotments have been in nonuse or minimal use (fewer than 25 horses) over the past 10 years, and fences exclude animals from the river reaches that occur within the allotments (Myers 2009, p. 47). Exclusion of livestock from the streams adjacent to Gila springsnail populations effectively protects springsnail habitat from the impacts of livestock grazing. If grazing allotment management were to change, potential impacts to springsnail habitat would be addressed at that time. However, it is not anticipated that livestock use will change in the foreseeable future (Forest Service 2004, p. 552; T. Brummett, Forest Service, pers. comm., 2009) and we expect the habitat of the Gila springsnail to continue to be excluded from livestock grazing. Although livestock grazing in and near the springs may have directly and indirectly affected the springsnails and their habitat in the past, the August 2008 and 2009 surveys did not find evidence that livestock grazing was negatively affecting the springs (Myers 2009, pp. 1-80). Because the majority of occupied springs have all been excluded from grazing, the effects of grazing on springs do not threaten the Gila springsnail.

Fire: Catastrophic fire was previously identified as one of the primary threats to the Gila springsnail and its habitat from burning riparian areas and subsequent ash, sediment, and chemical retardant flow into habitats (McDonald et al. 1996, p. 71; McDonald et al. 1997, p. 1375; Service 2005, p. 577). Tree density and accumulation of dead, woody debris has increased on National Forest System lands across the United States (Forest Service 2004, p. 30), and the effects of climate change have led to increased frequency, area burned, and length of fire season in the Southwest (Westerling et al. 2006, p. 941). Historical fire data shows that wildfires in the Southwest have become larger and more intense over the past 25 years (Forest Service 2004, p. 30), and several high-intensity fires have recently burned within the Gila National Forest (70 FR 24750, May 11, 2005, Forest Service 2009a, p. 3). For example, over 200,000 acres (80,900 hectares) burned in the Gila National Forest (70 FR 24750, May 11, 2005) in 2003, though not in the area occupied by the Gila springsnail. To date, fire has not affected any Gila springsnail sites.

When floods occur after fires, they deposit large amounts of ash and sediment into aquatic systems (Rinne and Jacoby 2005, p. 136). Ash adds nutrients to aquatic systems that can alter the balance between algae and invertebrate communities (Gresswell 1999, p. 205). Fires have been suggested as affecting other springsnail species in streams. For example, Lang (NMDGF, pers. comm., 2001) noted decreases in abundance of rare springsnail species on Bitter Lake National Wildlife Refuge in New Mexico following a wildfire. We would expect similar effects to the Gila springsnail if a wildfire burned in occupied Gila springsnail habitat. Ash and fine sediment is not suitable substrate for the springsnail, which prefer hard substrates. If a large ash flow were to occur into a spring, most of the habitat would likely become unsuitable. In addition, chemical retardants used to suppress fires are toxic to aquatic species (McDonald et al. 1996, p. 71; McDonald et al.

1997, p. 1375) and if they were to be used near springsnail habitat, individuals could be harmed. The Forest Service restricts the use of chemical retardants within 300 feet of aquatic features (Forest Service 2009b, p. 1), although these chemicals can be used within that buffer for the protection of life and/or property. While there have been no instances of chemical retardant releases in the immediate area of Gila springsnail habitat, in 2003, fire retardant was dropped in another location, on Black Canyon, Gila National Forest, affecting approximately 200 m (660 ft) of stream (70 FR 24750, May 11, 2005).

Because fire had been previously identified as a threat, fire risk was evaluated at each site visited during the 2008 and 2009 surveys (Myers 2009, pp. 1-80; Myers and Lang 2009, pp. 1-4). In general, the threat of fire was determined to be low because the springs are in wet, marshy areas that are unlikely to burn. In addition, the spring habitats do not occur within the confines of a drainage or channel that would likely transport ash flows or increased runoff because of fire in the larger upstream watershed. Additionally, these spring sites occur primarily on bedrock formations with shallow soils. Although these shallow soils support some grasses and forbs, there is not a forest or shrub overstory at most sites that would support a large enough fire to cause large changes in water chemistry or temperature. Jordan Spring does have a tree canopy, but this site is within the confines of the Middle Fork Gila River canyon, which is narrow and has very steep walls; virtually the entire area between the canyon walls is a riparian corridor. While it is possible that this corridor could burn, the likelihood of it is much less than in an upland forest. Even if the corridor itself does not burn, fires that occur after flooding can affect the springs through ash inputs. Although the downstream portions of this site could become inundated if the Middle Fork Gila River flooded, this site does not occur within a side drainage that would concentrate runoff or ash flow into occupied habitat. Therefore, because of the location and nature of the riparian areas around the habitat (spring sites), the effects of fire do not threaten the Gila springsnail.

Flooding: Because several of the occupied sites occur within the floodplain of the East Fork, Middle Fork, and mainstem Gila River, periodic flooding may temporarily affect some springsnail populations (Lang 2010, p. 27) by altering habitat through scouring or deposition of fine sediments. Natural flooding of these habitats has periodically occurred over time, and no major changes in these watersheds have altered the natural frequency and intensity of floods. The populations have survived periodic major floods and we do not anticipate that future floods would have any negative long-term effects on the springsnails or their habitats. In addition, flooding is a potential dispersal mechanism for the springsnails, washing snails downstream into new or different spring habitats, and providing for genetic interchange with populations in downstream springbrook sites (Martinez and Sorensen 2007, p. 31). Therefore, flooding is not a threat because they are natural events that are not expected to cause long-term negative effects to the Gila springsnail.

Groundwater Decline: Groundwater decline could potentially affect the Gila springsnail. As characterized above, the springs in which the Gila springsnail occurs have a very low discharge (less than 4 lps (1 gps)), and a short springbrook length, from 10 to 400 m (30 to 1,300 ft). A reduction in groundwater can result in a reduction in spring flows; however, we have no information on the hydrology of the springs in this area, and so we are unable to thoroughly assess the specific relationship between groundwater levels and spring flow. Nevertheless, any small change in discharge could make an important difference in available habitat. In this area, groundwater decline could occur through overuse for agricultural or geothermal purposes or drought. For a general discussion of the potential effects of drought, see the Climate Change section in Factor E (Other Natural or Manmade Factors Affecting Its Continued Existence).

The primary landowner in the area is the Gila National Forest; therefore, agricultural groundwater use in the vicinity of the Gila springsnail is relatively light and is not likely to be large enough to affect spring flows where the Gila springsnail occurs. Therefore, the primary potential use of groundwater in the area may be for geothermal purposes in the future. Geothermal power is the use of natural heat sources from the earth, such as thermal springs, to generate electricity. Extracting geothermal water could result in drawdown of connected shallower groundwater aquifers and, therefore, reduce the outflow of springs that are connected to that aquifer (Bureau of Land Management (BLM) and Forest Service 2008, p. 4-44). Given that the Gila springsnail occurs in many thermal springs, any geothermal development that occurred within the aquifer

connected to the Gila springsnail's habitat could threaten the species by possible loss of habitat through spring flow decline.

The BLM and Forest Service issued a Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (BLM and Forest Service 2008, pp. 1-1792), which analyzed the effects of geothermal leasing on the agencies' lands, including portions of Gila springsnail habitat on the Gila National Forest. This document did not initiate any site-specific geothermal development actions, although it indicates the potential for geothermal development to occur in areas such as the warm springs of the Gila National Forest. However, several factors make it highly unlikely that geothermal development would occur in these areas. There is a lack of infrastructure and water rights that would be necessary for a geothermal power plant to operate. The hot groundwater reservoir is located approximately 900-1,200 m (3,000-4,000 ft) underground (J. Witcher, New Mexico State University (NMSU), pers. comm., 2009). Drilling a well to this depth would be prohibitively expensive, considering how few people live in the potential delivery area for such a plant; therefore, revenue would likely be low. These factors make it highly unlikely that geothermal development would occur in this area (J. Witcher, NMSU, pers. comm., 2009). Further, the Forest Service and the New Mexico Energy, Minerals, and Natural Resources Department (NMEMNRD) have confirmed that there are no current plans for geothermal development in the Gila National Forest (Koss 2009, p. 1; S. Lucero, NMEMNRD, pers. comm., 2011). As a result, geothermal development does not threaten the habitat of the Gila springsnail because it is unlikely to occur in the foreseeable future.

Although the Gila springsnail has a small natural range (50 known sites along about 35 mi (56 km) of river), there has been no known decline from the historic range, and the populations have remained stable at all known locations. Further, the habitat has also remained stable, with no degradation or reductions in available suitable habitat. If the preliminary genetic information by Hershler and Liu (2010, p. 4) leads to a revision in the Gila springsnail taxonomy, the range will likely be smaller than previously thought. However, the small range of the Gila springsnail would not constitute a threat in the absence of other threats to the species or its habitat.

Summary of Factor A: An evaluation of threats to the habitat of the Gila springsnail shows the habitat to be secure, due in large part to the populations' occurrence in inaccessible areas on Forest Service and private lands. Disturbance to Gila springsnails from recreational activity is occurring rarely, with minimal impacts to the species' habitat, and is not likely to become a threat in the future due to the inaccessibility of the springsnail populations. Livestock grazing may have affected springsnails in the past, but exclusion of livestock from the riparian habitat by the Forest Service has removed this threat. Current springsnail populations are located in areas with minimal fire or flood risk. Groundwater decline within Gila springsnail habitat is unlikely to occur from geothermal development or other activities. We foresee no other threats to the habitat of the Gila springsnail. Due to the low risk of any substantial habitat disturbance to the current range as well as solely to the sites that would comprise the range of the Gila springsnail if a taxonomic revision occurs (the lower East Fork and mainstem Gila River), we have determined that the destruction, modification, or curtailment of habitat is not a threat to the Gila springsnail now or in the foreseeable future.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

There are very few people who are interested in or study springsnails, and those who do are sensitive to their rarity and endemism. Consequently, collection for scientific or educational purposes is very limited. We are not aware of any collection of the species other than by researchers confirming its discovery at new springs, and since the Gila springsnail occurs mostly on Forest Service land with limited access, we do not anticipate any future collections for other purposes. There are no known commercial or recreational uses of the springsnail. In addition, the State of New Mexico prohibits collection without a permit. For these reasons, we find that the Gila springsnail is not threatened by overutilization for commercial, recreational, scientific, or educational purposes now or in the foreseeable future.

C. Disease or predation:

The Gila springsnail is not known to be affected by any disease. At the time the springs were last surveyed, no nonnative predatory species were present (Myers 2009, pp. 1-80). Consumption by native predators could be occurring, but we have no reason to believe it would threaten the populations. Because there are no known nonnative species present and no known disease issues, we find that the Gila springsnail is not currently threatened by disease or predation now or in the foreseeable future.

D. The inadequacy of existing regulatory mechanisms:

The Gila springsnail is listed as a New Mexico State threatened species, Group 2, which are those species "...whose prospects of survival or recruitment within the state are likely to become jeopardized in the near future" (NMDGF 1988, p. 1). This designation provides protection under the New Mexico Wildlife Conservation Act of 1974 (i.e., State "Endangered Species Act") (19 NMAC 33.6.8), but only prohibits direct take of species, except under issuance of a scientific collecting permit. No permit has been issued for taking this species. The New Mexico Wildlife Conservation Act defines "take" or "taking" as "harass, hunt, capture, or kill any wildlife or attempt to do so" (17 NMAC 17.2.38). In other words, New Mexico State status as a threatened species conveys protection from collection or intentional harm to the animals themselves, although it does not provide habitat protection. Since we have not found any threats to Gila springsnail habitat, we do find this regulation to be adequate. The State threatened status alerts agencies and the public that the species is worthy of conservation and consideration in land and water management planning and, therefore, provides some benefit to the Gila springsnail.

We previously concluded in a biological opinion for the LRMP section 7 consultation that recreational use at Alum Spring was likely to kill, harm, and harass the Gila springsnail (Service 2005, p. 588). This was based on the lack of specific standards and guidelines within the LRMP that regulate recreation-related activities in wilderness areas (Service 2005, p. 588). As described above in Factor A, new information available from our updated field surveys in 2008 and 2009 find it unlikely that recreational use will actually impair Gila springsnail habitat due to the location of the populations and remoteness of the sites (Myers and Lang 2009, pp. 1-4).

The Southwest Region of the Forest Service has classified the Gila springsnail as a sensitive species because it is endemic to the Gila National Forest and nearby land, which means the Forest Service will develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions (Forest Service Manual 2670.22). All of the Gila springsnail sites from along the Middle Fork Gila River occur within the Gila Wilderness Area. In the Wilderness, no motorized travel is permitted and no development near occupied habitat would occur (Wilderness Act of 1964; 16 U.S.C. 1131-1136). The standards and guidelines listed in the Gila National Forest Land and Resource Management Plan (LRMP) also provide direction to the agency when site-specific forest management actions are proposed (Forest Service 1986, p. 21). Multiple standards and guidelines within this LRMP are applicable to the Gila springsnail and its spring habitat. For example, standards and guidelines can minimize the negative effect of range improvement projects on the East Fork and mainstem Gila River springsnail populations located within non-wilderness areas. Even when Forest Service projects follow the standards and guidelines from the Gila National Forest LRMP, both indirect and direct effects to the species may result. However, the resulting restrictions from the LRMP provide substantial protections to the habitat of the Gila springsnail. Summary of Factor D: The Gila springsnail is protected from direct harm by the New Mexico Wildlife Conservation Act, and habitat modification is prevented on Forest Service lands by standards and guidelines in the LRMP and by the location of several sites within the Wilderness Area. Therefore, we find that the Gila springsnail is not threatened by inadequate existing regulatory mechanisms now or in the foreseeable future.

E. Other natural or manmade factors affecting its continued existence:

Stochastic (Random) Events: Since additional locations of the Gila springsnail have been discovered (currently 50 known sites for all of the subgroups of the species), the species is much less vulnerable to the threat of elimination from stochastic human-caused or natural events than was originally thought. Several biological traits of a population have been identified as putting a species at risk of extinction (McKinney 1997, pp. 498-505; O'Grady et al. 2004, pp. 517-519). Some of these characteristics include having a localized range, limited mobility, and fragmented habitat (McKinney 1997, p. 499; Fagan et al. 2002, p. 3254; O'Grady et al. 2004, p. 518). With the discovery of additional populations in 2008 and 2009 (Myers and Lang 2009, pp. 1-4) in different spring complexes encompassing over 35 river mi (56 km) of river, the Gila springsnail is now known to occupy spring habitats along the Middle and East Forks and mainstem of the Gila River, which reduces the risk of the species being eliminated due to stochastic events. Therefore, we find that stochastic events are unlikely to threaten the species in the foreseeable future

If further study revises the taxonomy and describes the three subgroups of Gila springsnail as three separate species (Hershler and Liu 2010, p. 5), then the Gila springsnail would then occur in 13 populations over about seven river mi (11 km). The possible two new species (from the upper East Fork Gila River and Middle Fork Gila River (Hershler and Liu 2010, p. 4) would each have similar-sized ranges. All of these populations are in a variety of spring complexes with different distances to the river (ranging from directly adjacent to the river up to approximately 0.5 mi (0.8 km) away) and reasonable range to minimize the likelihood that a stochastic event would eliminate all of the populations of any one of the three subgroups. Therefore, even if the taxonomy is eventually revised, we find that stochastic events are unlikely to threaten the species in the foreseeable future.

Introduced Species: Introduced species are a serious threat to many native aquatic species (Williams et al. 1989, p. 18; Lodge et al. 2000, p. 7). Introduction of certain nonnative species into the Gila springsnail's habitat could cause problems. Red brome (*Bromus rubens*), buffelgrass (*Pennisetum ciliare*), and cheatgrass (*Bromus tectorum*) are nonnative plants that have all been documented in the vicinity of Gila springsnail populations (Powell et al. 2006, p. 49). These grasses dominate the vegetation where they occur, crowding out other species and out-competing native plants for water (Tellman 2002, p. 13). In high densities, these species can result in hotter, more frequent fires than fires burning native species (Tellman 2002, p. 15), which could threaten the Gila springsnail if these plants grew near occupied springs. Currently, these species do not occur near or around the springs inhabited by the Gila springsnail, nor are they likely to grow on the rock ledges or marsh areas in which the species is found. Therefore, these nonnative plants are not a threat to the Gila springsnail.

Saltcedar (*Tamarix* spp.) threatens spring habitats primarily through the amount of water it consumes and from the chemical composition of the leaves that drop to the ground and into the springs. Saltcedar leaves that fall to the ground and into the water add salt to the system, as their leaves contain salt glands (DiTomaso 1998, p. 333). Saltcedar is present on the Gila National Forest in very limited quantities along the forks and the mainstem of the Gila River, although none is known to occur near the springs inhabited by the Gila springsnail. It is very limited and the Gila National Forest has been treating discovered infestations by mechanical removal and painting the stumps with herbicide (J. Monzingo, Gila National Forest, pers. comm., 2011).

Nonnative mollusks have affected the distribution and abundance of native mollusks in the United States. Of particular concern for the Gila springsnail is the red-rim melania (*Melanoides tuberculata*), a snail that can reach tremendous population sizes and has been found in isolated springs in the west (McDermott 2000, pp. 13-16; Ladd 2010, p. 1; U.S. Geological Survey 2010, p. 1). The red-rim melania has caused the decline and local extirpation of native snail species, and it is considered a threat to endemic aquatic snails that occupy springs and streams in the Bonneville Basin of Utah (Rader et al. 2003, p. 655). It is easily transported on gear or aquatic plants, and because it reproduces asexually (individuals can develop from unfertilized eggs), a single individual is capable of founding a new population. It has become established in isolated desert spring ecosystems such as Ash Meadows, Nevada; Phantom Lake Spring, San Solomon Spring and Diamond Y Spring, Texas; and Cuatro Cienegas, Mexico. In many locations, this exotic snail is so numerous that it

essentially is the substrate in the small stream channel. Because of its high reproductive capacity and abundance, red-rim melania may outcompete native hydrobiid snails for food resources and space (Ladd, 2010, p. 11).

Another nonnative snail, the New Zealand mudsnail (*Potamopyrgus antipodarum*), has invaded aquatic habitats throughout the west. It was discovered in 1987 in the middle Snake River, Idaho (Riley et al. 2008, p. 509) and is now found in all western states except New Mexico (Montana State University 2007, p. 1). These tiny snails (~7 mm (0.27 in) long) are parthenogenic (eggs develop without fertilization) livebearers with a high reproductive potential; densities of mudsnails can be extremely high (800,000 snails/m²) (Montana State University 2007, p. 2). Because New Zealand mudsnails can withstand extended periods of desiccation, this species can colonize new areas relatively easily by transport from recreationists and aquatic researchers who may contact infested waters. At high densities, the New Zealand mudsnail can consume available resources and outcompete native spring species (Riley et al. 2008, p. 518). However, because the New Zealand mudsnail has not been found in New Mexico, it is not a threat to the Gila springsnail.

Additionally, four species of nonnative crayfish (*Orconectes rusticus*, *O. virilis*, *O. immunis*, *Procambarus clarkii*) have been introduced to New Mexico (Hobbs et al. 1989, p. 302). Crayfish forage on plants and invertebrates and limit available biomass in streams and springs (Creed 1994, p. 2101). Nonnative crayfish decimate aquatic plant beds and populations of associated snail species (Lodge and Lorman 1987, p. 504-505). These species are not currently found in the Gila National Forest; because their introduction is generally through releases (i.e., by anglers as bait, aquarium release, or by aquaculture) rather than colonization, it is unlikely they will invade the relatively inaccessible springs in which the New Mexico springsnail are found in the foreseeable future, because it is unlikely anglers will transport them to these areas. Therefore, introduced crayfish are not a threat to the Gila springsnail.

Other than saltcedar, which is present in limited quantities and is being actively controlled by the Gila National Forest, none of these nonnative species are known to currently occur in the springs where the Gila springsnail is found in at this time, and so potential impacts have not been realized. While these or other nonnative species could be introduced to the habitat of the Gila springsnail, the remote location of the habitat reduces the risk of human introductions. Therefore, nonnative species are not considered a threat to the Gila springsnail.

Climate Change: The Southwest may be entering a period of prolonged drought (McCabe et al. 2004, p. 4140; Seager et al. 2007, pp. 1181-1184). Drought affects both surface and groundwater resources and can lead to diminished water quality and quantity (Woodhouse and Overpeck 1998, p. 2693; MacRae et al. 2001, p. 4). The springs do not have to dry out completely to have an adverse effect on populations of springsnails. Decreased spring flow could lead to a decrease in habitat availability and dissolved oxygen levels and increased water temperature fluctuations, salinity, and dissolved solids (MacRae et al. 2001, p. 4). Any of these factors, alone or in combination, could lead to either the reduction or extirpation of populations of Gila springsnails as a result of declining spring flows.

The Intergovernmental Panel on Climate Change (IPCC) projects that there will very likely be an increase in the frequency of hot extremes, heat waves, and heavy precipitation events (IPCC 2007, p. 7). Climate forecasts project a northward shift in the jet stream and associated winter-spring storm tracks, which are consistent with observed trends over recent decades (Karl et al. 2006, p. 7). This would result in future drier conditions for the southwest and an ever-increasing probability of drought for the region (Trenberth et al. 2007, p. 262). It is anticipated that an increase in extreme events would most likely affect species living at the edge of their physiological tolerances.

An increase in average mean air temperature of just over 2.5°F (1°C) in Arizona and just under 1.8°F (1°C) in New Mexico since 1976 has already been documented (Lenart et al. 2007, p. 3). However, the effect climate change may have on springs and forests of the Southwest is unpredictable. It is anticipated that higher air temperatures would lead to increased evapotranspiration rates and reduced soil moisture, which could

reduce the amount of groundwater recharge and, consequently, spring discharge. The springs in which the Gila springsnail lives have a very low discharge, and any small change in discharge could make an important difference in available habitat. However, we have no information on the geohydrology of the groundwater that supports spring flows where Gila springsnails occur, so we cannot draw strong conclusions on the relationship between precipitation and spring flow. In addition, the small volume of water issuing from these springs means that the water temperature is more easily changed by air temperature. However, the temperature tolerances of Gila springsnail are unknown and we do not have any information to adequately evaluate the effects of changing water temperatures on the species.

Climate change may be a significant, long-term source of stress that indirectly exacerbates other potential threats by mechanisms such as increasing the likelihood of prolonged drought that would reduce groundwater availability and result in future habitat loss. However, we do not currently have sufficient information to determine to what extent the consequences of climate change may affect the Gila springsnail. Both the magnitude (the extent of any specific effects) and the imminence (when the effects might occur) of the future effects of climate change remain highly uncertain. Climate change may serve to exacerbate other current or future concerns for habitat loss from other factors. However, since we have determined that the Gila springsnail is not threatened with habitat loss, we cannot predict with any certainty that the effects of climate change will exacerbate future habitat concerns sufficiently to consider climate change a threat to the species on its own. The degree of impact would depend on the intensity and longevity of Gila springsnail habitat changes that may occur, and these changes cannot be predicted with any certainty in the foreseeable future. Therefore, we have determined that climate change is not currently a threat to the Gila springsnail.

Summary of Factor E: The discovery of many additional populations of Gila springsnail throughout its range demonstrates that the species is protected from elimination from random natural events. There are no nonnative species present at the springs inhabited by the Gila springsnail, nor are they likely to be introduced to the species' habitat in the foreseeable future. Additionally, we cannot predict with any certainty that the effects of climate change will exacerbate future habitat concerns sufficiently to consider climate change a threat to the species on its own. Therefore, other natural or manmade factors do not threaten the Gila springsnail now or in the foreseeable future.

Conservation Measures Planned or Implemented :

Currently, the majority of occupied Gila springsnail sites are excluded from livestock grazing. Excluding livestock from riparian areas, particularly thermal springs, helps maintain springsnail habitat and protect water quality.

Summary of Threats :

The long-term persistence of the Gila springsnail is contingent upon protection of the riparian corridor and maintenance of flow to ensure continuous, oxygenated flowing water within the species' required thermal range (Taylor 1987, p. 18; Mehlhop and Vaughn 1994, p. 72; Lang 1998, p. 61; Forest Service 2004, p. 529). We foresee no threats to the habitat of the Gila springsnail. Disturbance to the species from recreational activity is occurring rarely, with minimal impacts to the species, and is not likely to become a threat in the foreseeable future due to the inaccessibility of the springsnail populations. Livestock grazing may have affected Gila springsnails in the past, but exclusion of livestock from the riparian habitat has removed this threat. Current springsnail populations are located in areas with minimal fire or flood risk. Groundwater use for geothermal development is unlikely to occur within Gila springsnail habitat. Additionally, the discovery of additional populations in 2008 and 2009 reveals the species is secure from stochastic habitat-modifying events.

The distribution of the species and variance in the location of its habitat reduces the risk of the loss of the species from stochastic habitat-modifying events. We have no information regarding any systematic

collection of the species other than by researchers confirming its discovery at new springs, and since the Gila springsnail occurs on Forest Service land with limited access and requires a State permit to be collected, we do not anticipate any future collections for other purposes. There are no known diseases that affect Gila springsnails, and no native or nonnative predators occur at these springs. Additionally, we are not aware of any introduced species at the springs that would affect the springsnails.

Climate change may serve to exacerbate habitat loss from other factors; however, since we have determined that the Gila springsnail is not threatened with habitat loss, we cannot predict with any certainty that the effects of climate change will exacerbate future habitat concerns sufficiently to consider climate change a threat to the species on its own. Therefore, we have determined that climate change is not currently a threat to the Gila springsnail now or in the foreseeable future.

In conclusion, due to the lack of threats to the continued existence of the Gila springsnail now or in the foreseeable future under any of the five factors, we find that the Gila springsnail no longer warrants listing throughout all or a significant portion of its range.

For species that are being removed from candidate status:

 No Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

Description of Monitoring:

NMDGF has been the agency monitoring the populations of the Gila springsnail. The type locality was monitored in October 2001 and June 2002. Although density estimates are not currently known for the species, populations of the Gila springsnail were reported as stable (NMDGF 2002). In 2008 and 2009, NMDGF and Service biologists documented occupied locations of the Gila springsnail, 37 more than were previously known. Additional surveys are planned for 2011.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

New Mexico

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

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Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

06/01/2011

Date

Concur:

10/07/2011

Date

Did not concur:

Date

Director's Remarks: